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GB 756610
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(54) Filter Apparatus

(57) An edge filter element is made by forming a coil of wire material coated with a film of material, e.g. tin or zinc, and then chemically removing the film, e.g. using acid, to provide clearances between adjacent coil strands. The wire is wound around an apertured frame work which may be circular, hexagonal, or square in cross-section, the framework having apertured end supports. The filter element is positioned within a container 5 containing fluid to be filtered. The element is cleaned by back flushing with gas under pressure from line 17 either after a pre-set time, or when a device has determined a predetermined pressure differential between the pressure, P_1 of the filtrate and the pressure P_2 of the fluid, e.g. water or air, in container 5.

FIG.1

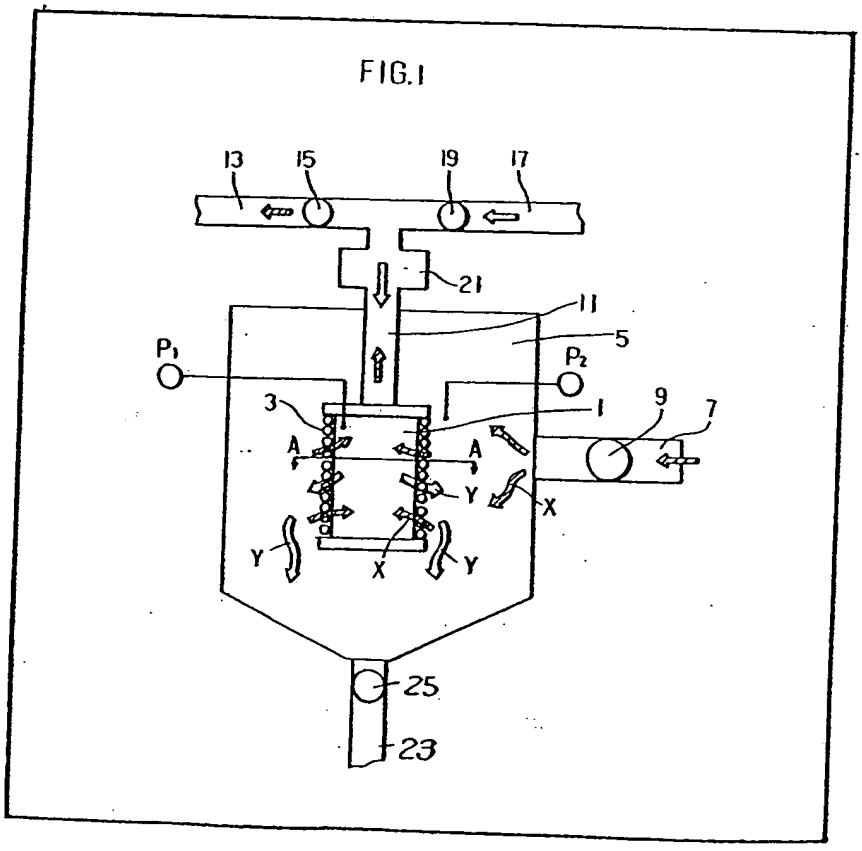

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FIG.1

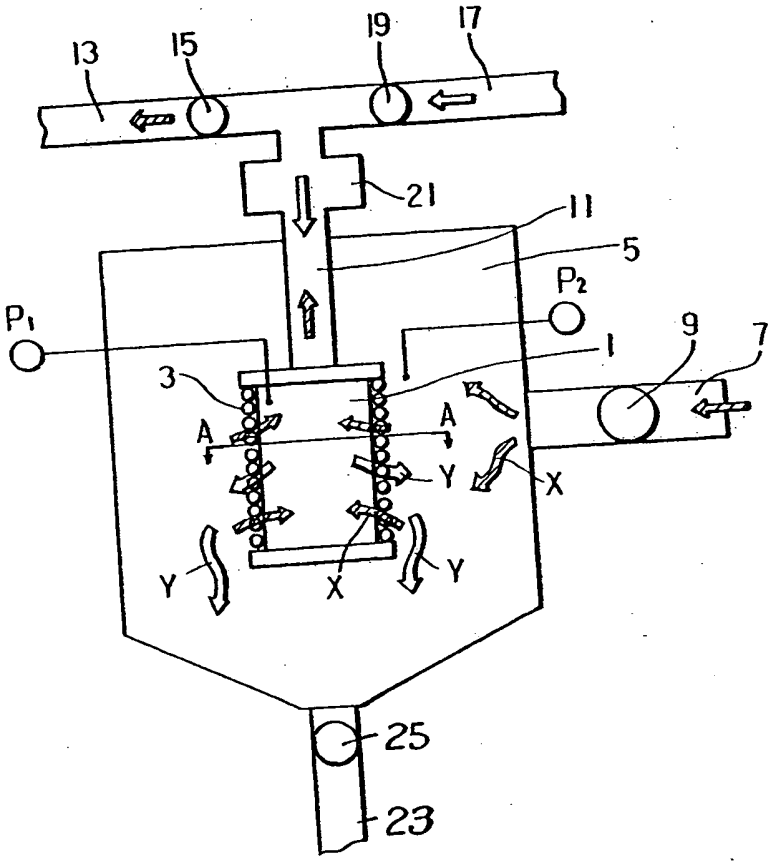

FIG.2

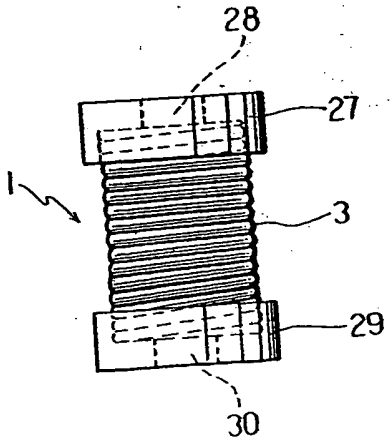

FIG.3

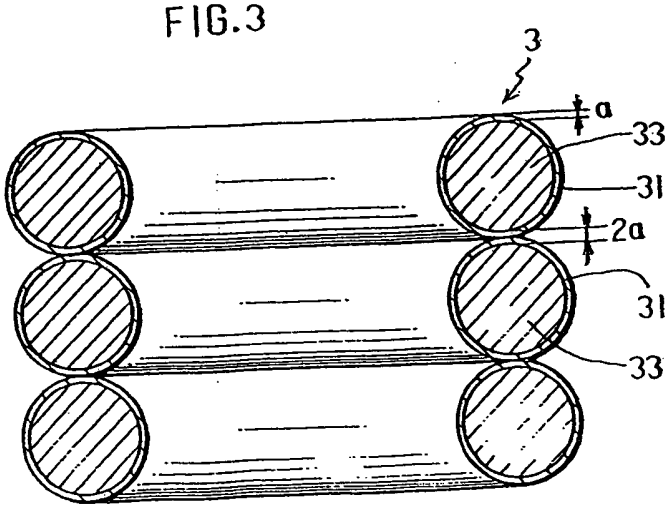

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FIG. 4

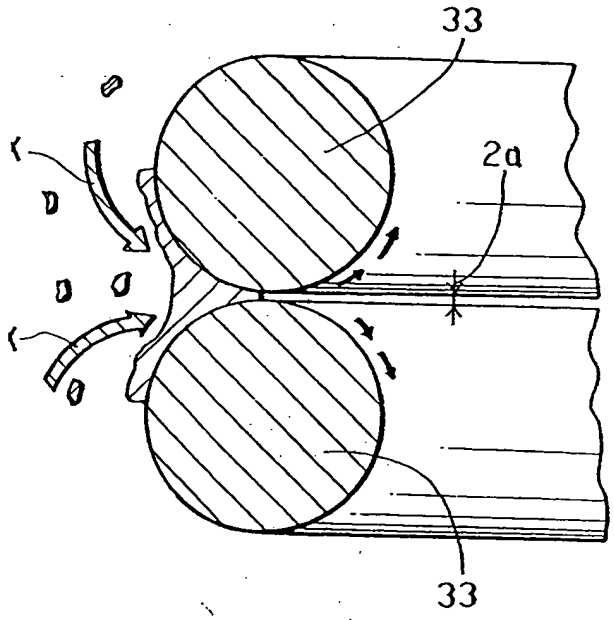


FIG. 5

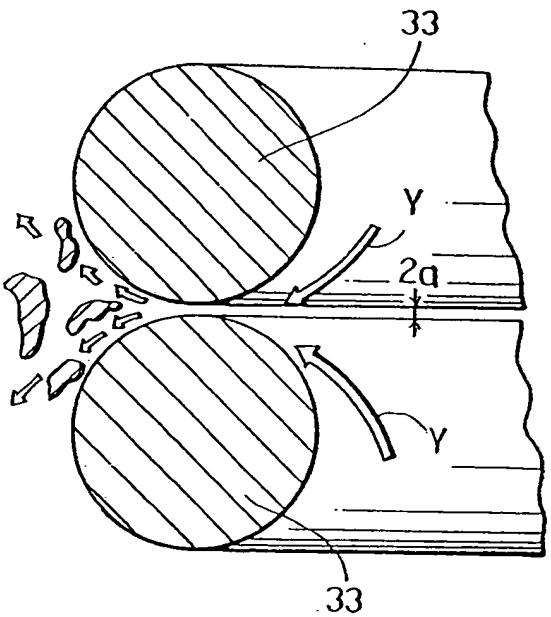


FIG. 6

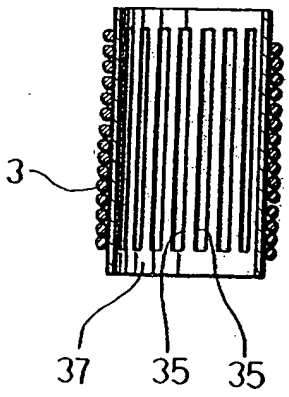


FIG. 7

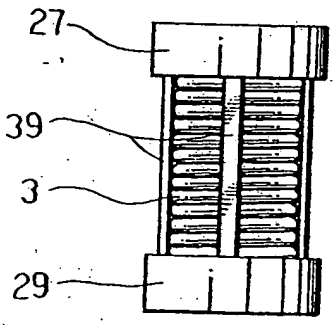


FIG. 8

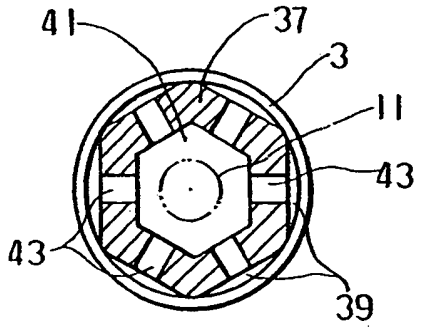


FIG. 9

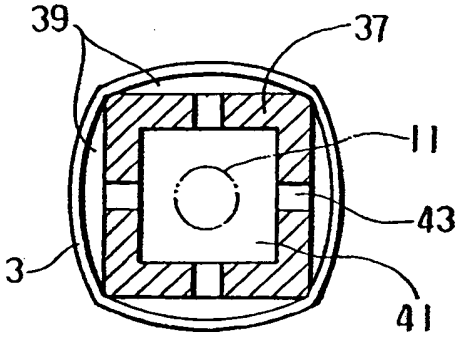


FIG. 10

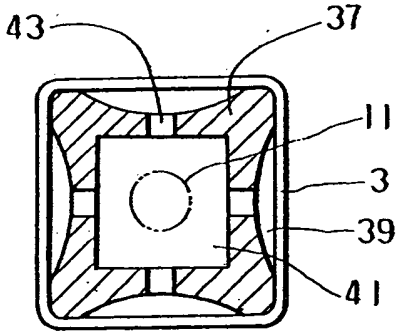


FIG. 11

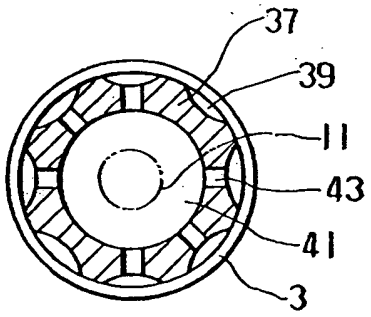


FIG. 12

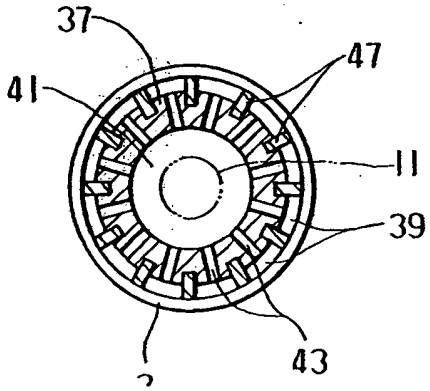
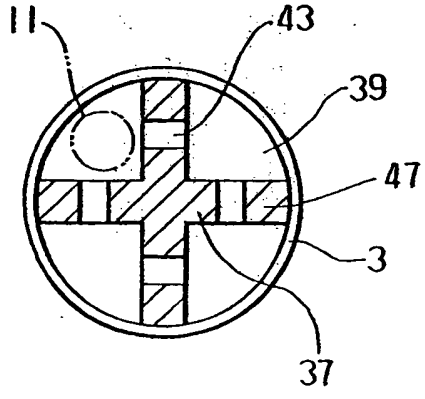


FIG. 13



SPECIFICATION
Filter Apparatus

The present invention relates to a filter apparatus which functions to remove minute floating matters existing in a fluid (principally water or air) and regenerate it as a fresh fluid.

In conventional filter apparatus, filter cloth, metallic gauze or punched board, for example, are employed as the filtering material. However, these filters are expensive, are relatively inefficient in filtering finer materials, and are prone to deformation due to a low mechanical strength when washing is performed by reversed flow to remove the filtered material. Moreover, they are not suitable for modern mass-production methods and have a poor filtering efficiency and are of poor durability.

An object of the present invention is to obviate or mitigate the aforesaid problems and to provide a filter apparatus of low cost and high capacity. Another object of the present invention is, for effective filtering of contaminated fluid, to provide a method of back flush washing the filter apparatus employing a high-pressure gas.

Embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 is a diagrammatic view of the filter apparatus in accordance with the invention in use;

Fig. 2 is a front view of the filter apparatus in accordance with the present invention;

Fig. 3 is an enlarged sectional view of the filtering material;

Fig. 4 and Fig. 5 are enlarged sectional views showing the functioning of the filter in accordance with the present invention;

Fig. 6 and Fig. 7 are respectively a sectional view and a front view showing another embodiment of the present invention;

Fig. 8 to Fig. 13 are various views in cross section along the line A—A of Fig. 1 showing other embodiments of the present invention.

Fig. 1 shows a filter apparatus in which a fluid filter 1 is provided with a cylinder or polygon of filtering material 3. A fluid reservoir 5 surrounds the fluid filter 1 and has at one side an inlet pipe 7 provided with an on-off valve 9. A pipe line 11 extends upwardly from the fluid filter 1. Pipe line 11 merges with a horizontal pipe line 13 which is provided with an on-off valve 15. A horizontal high-pressure inlet gas pipe line 17 provided with an on-off valve 19 merges with pipe lines 11 and 13. A collecting chamber 21 is arranged in pipe line 11.

P1 represents a device for measuring pressure inside the fluid filter 1 and P2 a device for measuring pressure inside the fluid reservoir 5. At the bottom of the fluid reservoir 5 is provided a discharge pipe line 23 incorporating an on-off valve 25.

The fluid filter 1 consists of a cylinder or polygon of filtering material 3 and support members 27, 29 at the cylinder ends. The filtering material 3 is formed of wire 33 (for example stainless steel wire) which is covered with a film 31 of materials which are removable by chemical treatment (for example tin Sn, or zinc Zn), the wire being tightly wound to a cylindrical coil or a polygonal coil and the material 31 being removed, subsequent to a straightening operation of the wire, by a film removing agent (for instance an acid agent which dissolves Sn or Zn films). Thus, after removal of the film 31, clearances with a thickness of $2a$, which is twice as thick as that of the film 31, are left between adjacent wires 33 and are uniformly distributed all along the coil as shown in Figs. 3 to 5. The magnitude of the clearance $2a$ can be suited to the purpose and application of the filter apparatus.

For strength the filtering material 3 may be mounted on a frame work 37 perforated by a number of slots 35 (or holes) as shown in Fig. 6, or the coil may by supported by providing spaced coil retainers 39 between the support members 27, 29 as shown in Fig. 7.

The fluid filter 1 can consist of filtering material 3 deposited in laminate manner around the frame work 37 as shown in Figs. 8 to 13, and support members 27, 29 may be provided on both ends of the frame work 37 for retaining the filtering material 3. The filtering material 3 may be made in such a way that, after the wire material is coated with a suitable film, the coated wire is wrapped around the frame work 37 into a coil in laminate fashion, then the film is removed by resolution to leave minute clearances. Alternatively, the wire may be wrapped around the frame work in laminate fashion with subsequent coating of the wire, or the coil may be constituted by corrugated rings or radially slit rings assembled in laminate fashion. Between the frame work 37 and the filtering material 3 are formed a number of clearances 39 as shown in Fig. 8 and these clearances 39 and the void space 41 defined by the frame work 37 are connected by holes 43. The void space 41 is in communication with the pipe line 11. Fig. 8 shows the cross section of the frame work 37 to be hexagonal and the filtering material 3 is wrapped around the frame work 37 in circular form. The cross section of the frame work 37 may be square as shown in Figs. 9, the four sides of the filtering material 3 each being arcuate. Fig. 10 and Fig. 11 show the frame work 37 provided with concavities on its periphery, Fig. 10 showing a square section frame work, and Fig. 11 a circular section frame work. In Fig. 12, a plurality of ribs 45 along the periphery of the frame work 37 space the filtering material 3 to define clearances 39 and in Fig. 13 the frame work 37 consists of a plurality of radially-extending ribs 47, provided with holes 43 to allow each clearance 39 to communicate with the pipe line 11. The holes may be round or oblong.

This invention has wide application and when it is applied as shown in Fig. 1, with a hole 28 of the support member 27 of the fluid filter 1 connected *via* the pipe line 11 to a suction

apparatus, such as a pump (not shown), and with the hole 30 in support member 29 closed by a plug, and the whole assembly immersed in a contaminated fluid including matter to be filtered out then by operating the pump, the contaminated fluid stored flowing into the tank 5 from the inlet pipe line 7 is filtered by passing through the clearances 2*a* of the wire material 33, as shown by an arrow X in Fig. 1 and Fig. 4, and the clean fluid passes up pipe line 11 and along pipe line 13.

As filtration proceeds, the clearances become loaded with the separated matters, generating thus a difference of pressure between the inside of the fluid filter apparatus 1 and the fluid in the tank 5. This condition can be either detected automatically by the pressure detectors P1 and P2 or by a timer at predetermined time intervals.

Upon detection of a predetermined pressure differential the on-off valves 9, 15 are closed and the on-off valve 25 opened. Thus, the contaminated fluid inside the fluid reservoir 5 is drained through the outlet fluid pipe line 23 and then a part of the normally cleaned fluid inside the fluid filter 1 is caused to flow out through the filtering material 3. In this condition, by means of the detecting apparatus, manual or automatic opening of the on-off-valve 19 is effected and a high-pressure gas flow through the highpressure gas inlet pipe line 17 to compress the normally cleaned fluid inside pipe line 11 and the fluid filter 1.

As shown in Fig. 5, the clean fluid flows out under high-pressure through the clearances 2*a* formed between the wire material 33 and dislodges contaminant material that has blocked the clearances, which material drops to the bottom of the fluid reservoir 5, that is, a flow is produced in the direction shown by arrow Y in Fig. 1. Thus, blocking of the filter clearances is eliminated allowing free flow of fluid. When this condition is detected the on-off valves 19 and 25 are closed and the on-off valves 9 and 15 opened. Thus filtering of contaminated fluid can be re-commenced.

By providing the collecting chamber 21 in the pipe line 11, an uneconomic discharge of a large amount of the cleaned fluid can be avoided and the reverse flow washing of the filter can be completed with the substantial quantity of clean fluid in the fluid filter 1 and the pipe line 11.

The present invention provides a fluid filter of simple construction for treating large amounts of contaminated fluid, and offers the optimum construction for the regeneration of such contaminated fluid

Claims

1. A filter apparatus comprising a cylindrical or polygonal coil of wire material coated with a film which is chemically removable to provide clearances between adjacent coil strands.

2. A filter apparatus as claimed in claim 1 in which the wire material is supported by a framework.

3. A filter apparatus as claimed in claim 2 in which the wire material is wound around the frame work in laminate fashion.

4. A filter apparatus as claimed in claim 2 or 3 in which the frame work is provided with apertured end supports.

5. A filter apparatus as claimed in any one of claims 2 to 4, comprising clearances between the wire material and the framework.

6. A filter apparatus as claimed in claim 3 or 4 in which the framework is of hollow perforated construction.

7. A filter apparatus as claimed in claim 4 in which the end supports are interconnected by spaced coil retainers external of the coil.

8. A filter apparatus as claimed in claim 3 or 4 in which the frame work is of cruciform configuration with each limb thereof apertured.

9. A filter apparatus as claimed in any preceding claim in combination with a container for contaminated fluid with a pipeline for filtered fluid in communication with the void inside the coil.

10. A filter apparatus as claimed in claim 9 in which a source of high-pressure gas is adapted to be connected to the pipe line and is operable to force clean fluid in the pipe line and coil in reverse flow out of the coil to remove any blockages in the clearances.

11. A filter apparatus, substantially as hereinbefore described with reference to Figs. 1 to 5 or Fig. 1 and any one of Figs. 6 to 13 of the accompanying drawings.

12. A method of cleaning a filter apparatus as claimed in any preceding claim comprising the step of applying high-pressure gas to the coil interior to force clean fluid therein in reverse flow out of the coil to remove any blockages in the clearances.

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